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Mel Price – Auxiliary Lock Downstream Miter Gate Repair

Navigation Lock and Dam Inspection and Emergency Repairs Workshop 18 - 20 April 2006

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Mel Price Locks and Dam

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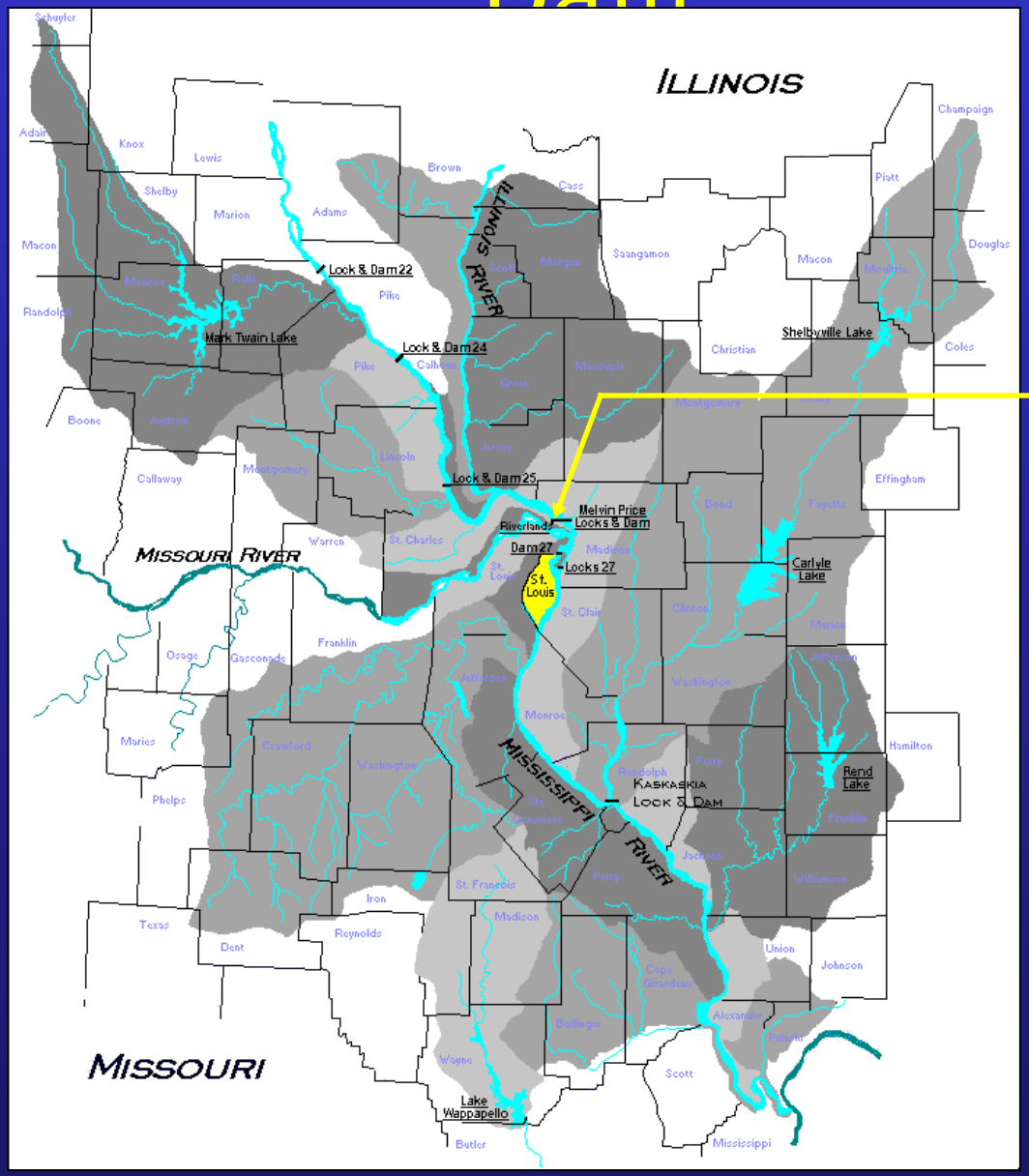

Project Location

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Mel Price Locks and Dam

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Mel Price Accident
3 October 2004

What Happened?

Why Did It Happen?

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Mel Price Accident

What Happened?

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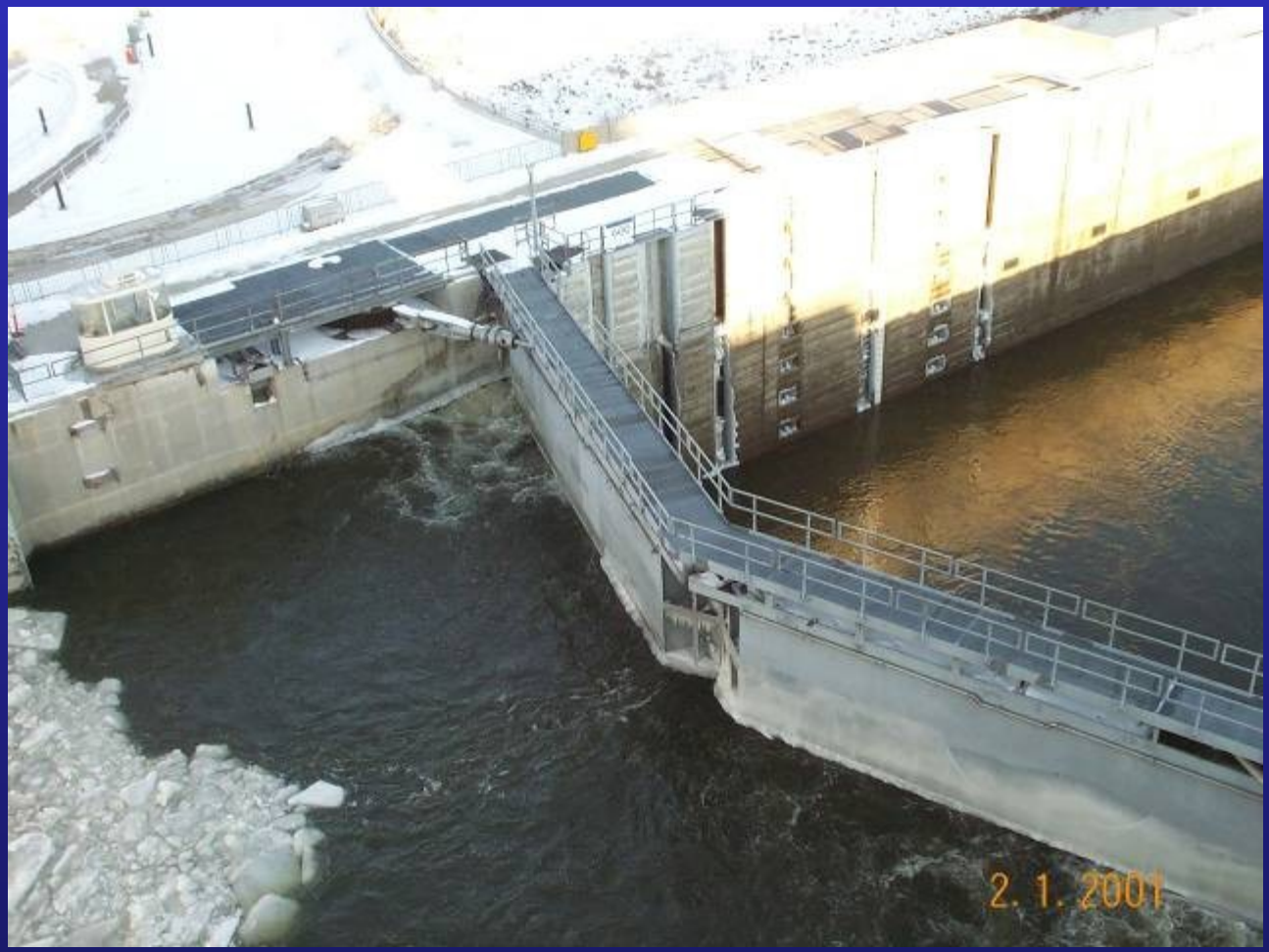
Miter Gate Functioning Normally



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Gate Leafs Forced Downstream From Normal Mitered Position

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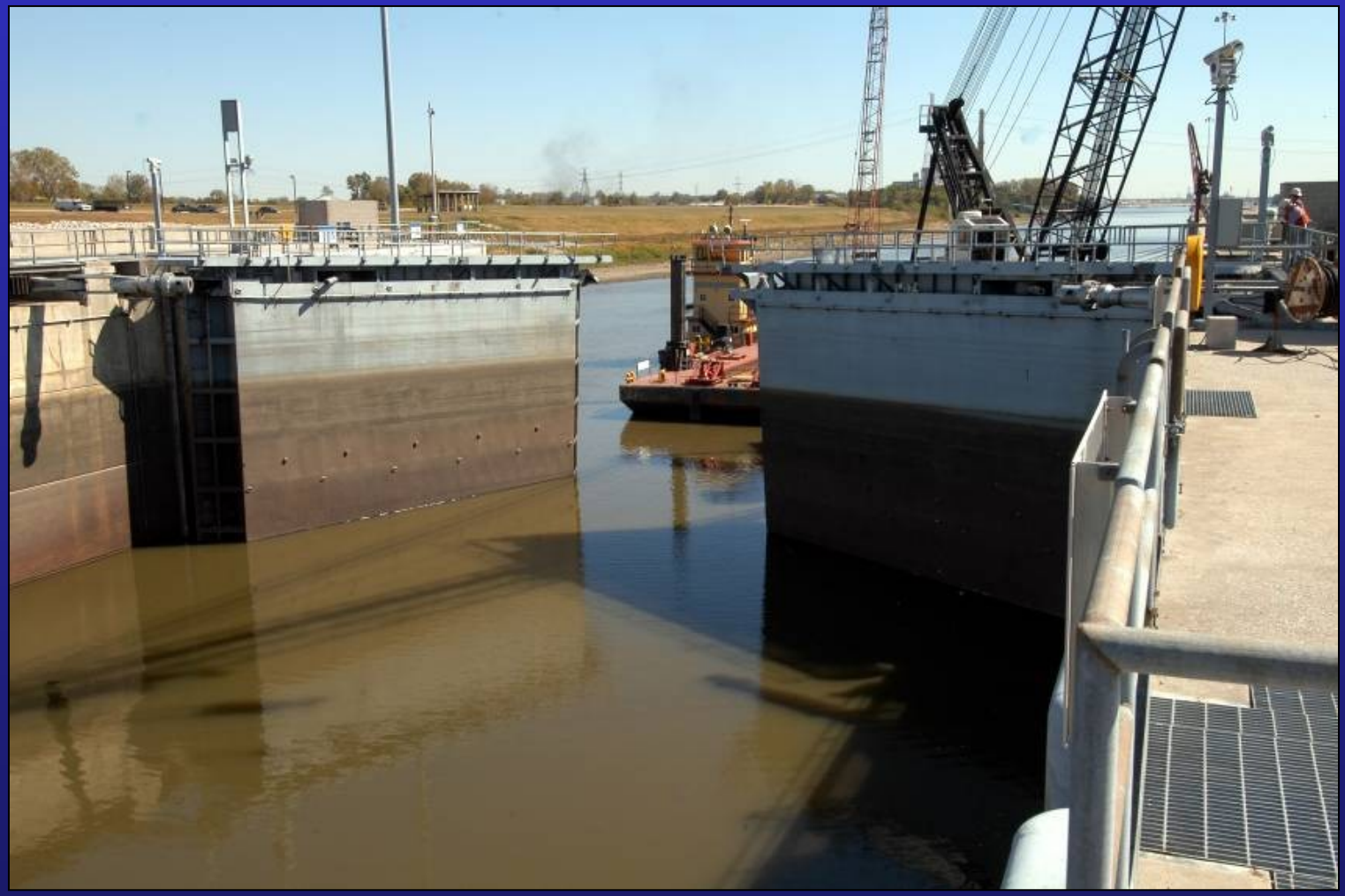
Gate Leafs Forced Downstream From Normal Mitered Position



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Damage Summary

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Damage to Gate Anchorages

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Damage to Gate Anchorages

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Damage to Gate Anchorages

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Failed Operating Struts

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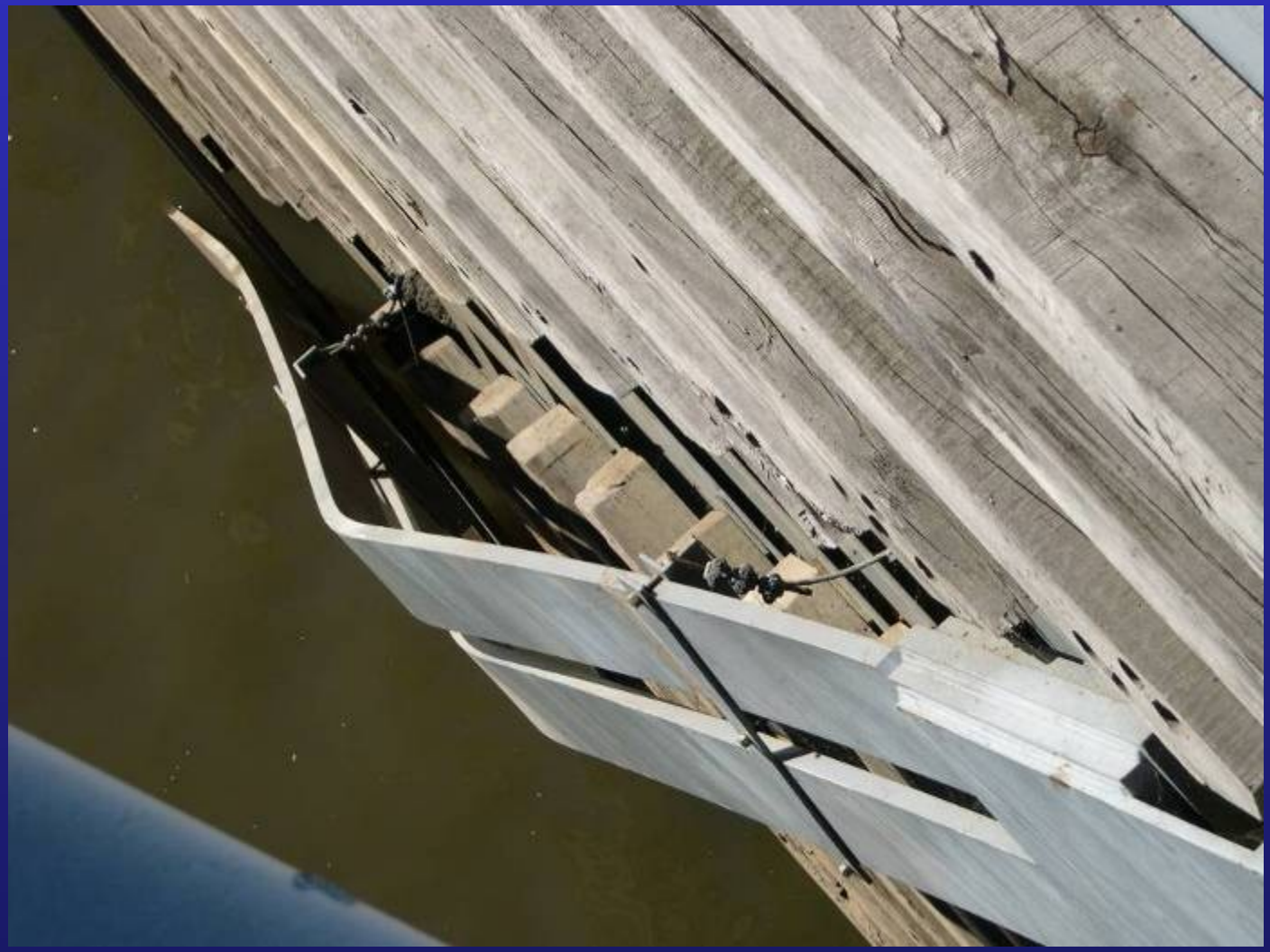
Diagonal Failure



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Damage to Miter End of Leafs

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Pintle Socket Sheared Off

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Bent & Cracked Pintle Socket

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Pintle Ball Retainer Sheared Off

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Bottom Seal Damaged

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Why Did It Happen?

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Gate Operating Arm

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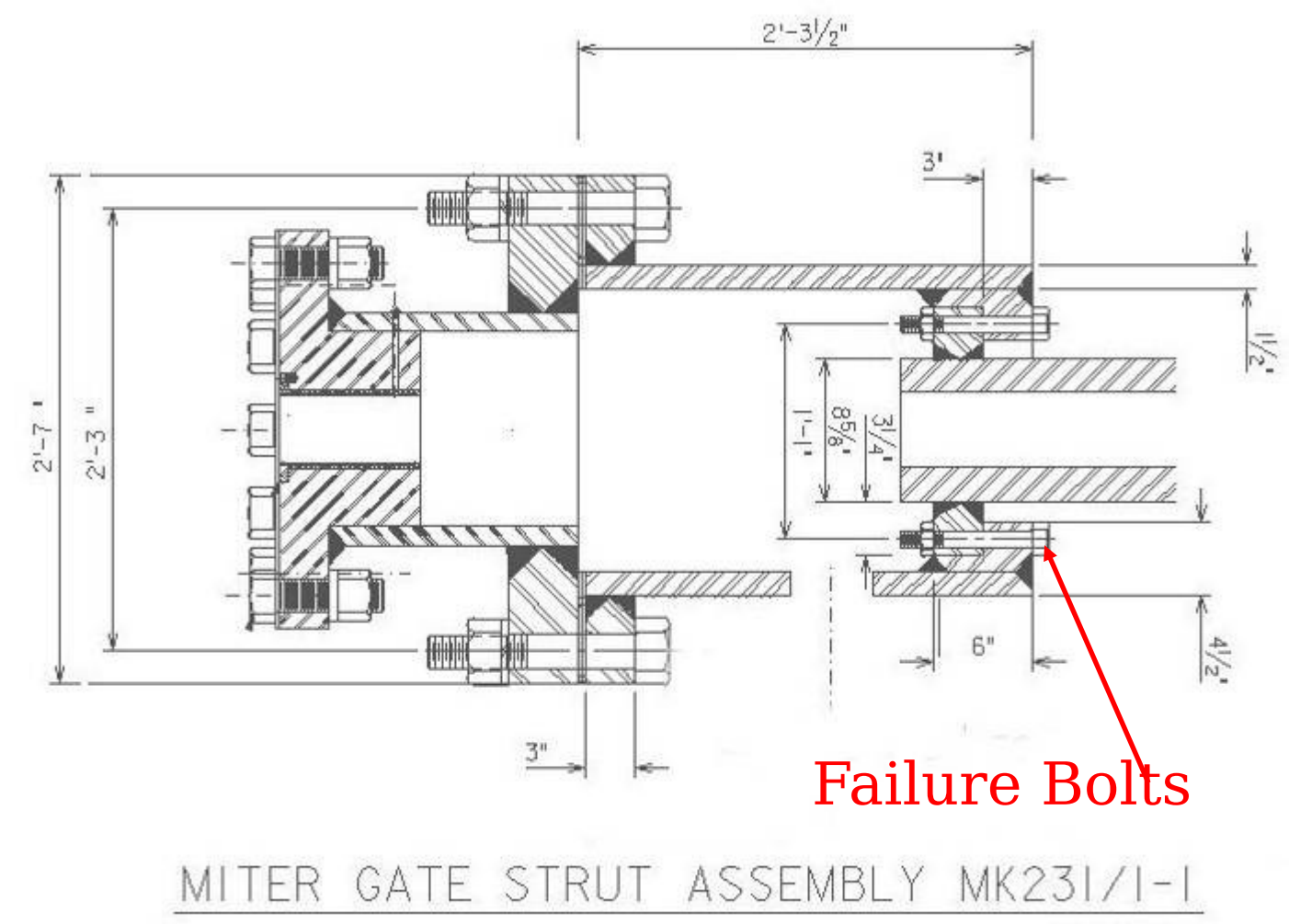
Operating Arm Failure Tube



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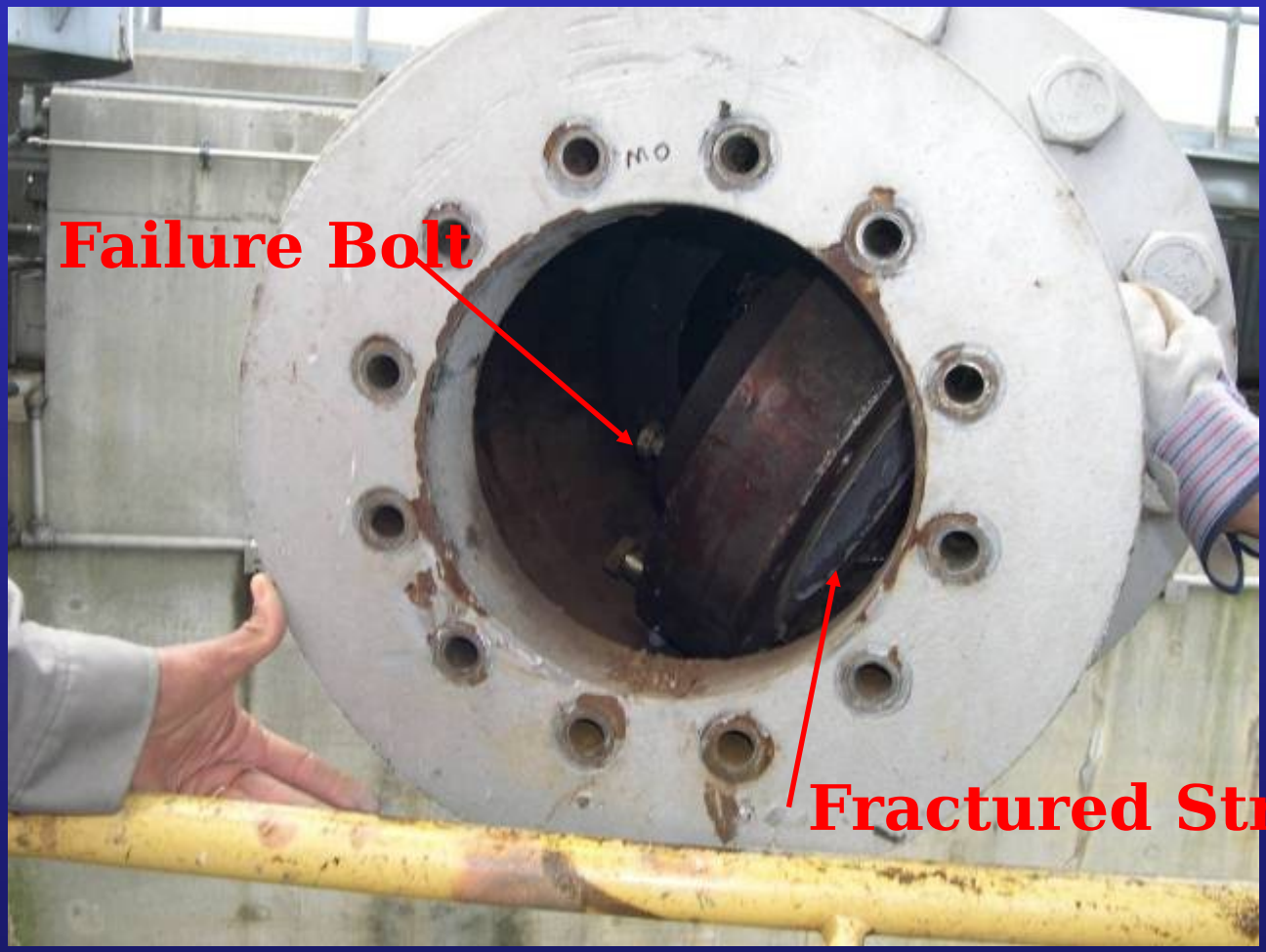
Failure Tube



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Normal Miter Block Position

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Gate Control Stations

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Magnetic Proximity Switch on Gate

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Switches on Machinery Rack

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Modification of PLC Logic

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Miter Gate Sill

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Miter Gate Sill

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Investigation Report Findings

- Increased hydraulic system relief pressures and fracture of the strut failure tube failure bolts.
- Leaves not mitered.
- PLC programming incorrectly indicated that the downstream gate was mitered (closed).
- No operator verification of miter or intervention.
- Filling of lock chamber with the downstream gate leaves not in miter.
- Appreciable unbalanced head on the unmitered downstream gate leaves
- Catastrophic failure – miter gate leaves move past miter

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Actions Taken By MVS Based on Report Recommendations

1. Standard Operator Procedures and Training
2. Programming Ladder Logic Control
3. Additional Miter Gate Switch
4. Policy on Changes and Inter-Office Coordination
5. Relief Valve Gages and Mechanical Linkages

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Helper Boat – Main Lock

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Inspection – Main Lock

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All-Discipline Team

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Concentrate On Critical Activities

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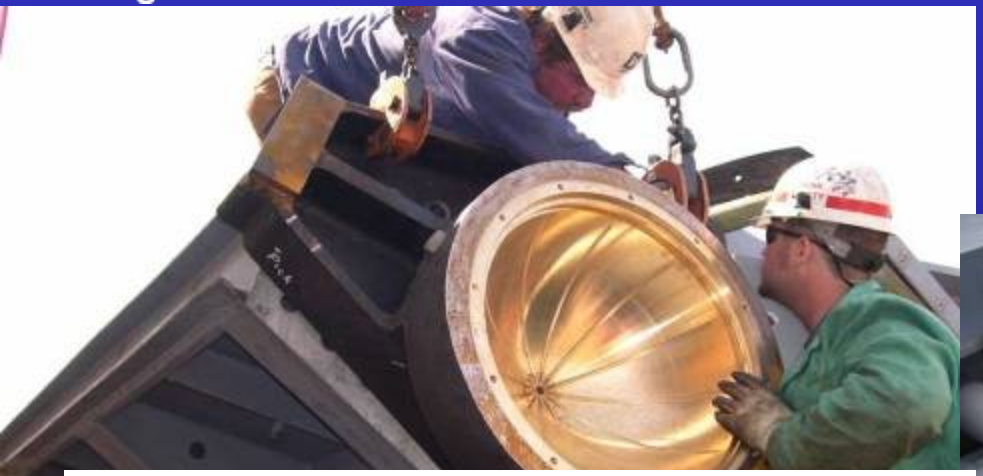

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Variety of Contract Instruments

Best Value
AE IDIQ
MIPR
Purchase Order
Lump Sum Contract
Credit Card

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Gate Repairs

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Gate Repairs

Pulling Gate

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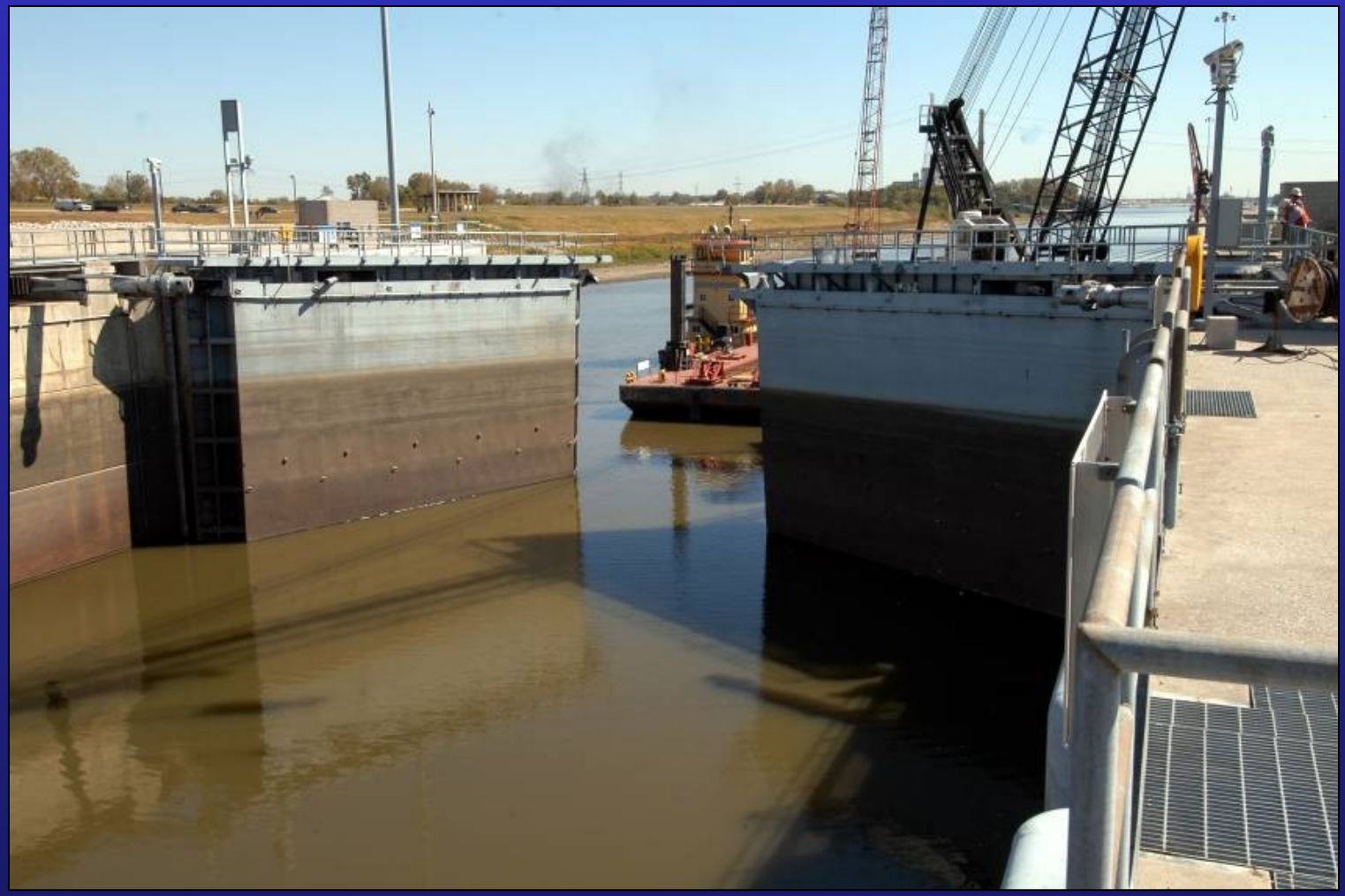
Position of Leafs After Accident



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Cutting Gate Anchors

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Removing Illinois Leaf

Crane “Hercules”

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Placing Illinois Leaf on Spare Gate Barge

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Guy Cables Installed

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Guy Cables Installed

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Both Leafs Secured on Spare Gate Barge

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Damage Inspection

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Surveying Damaged Gate

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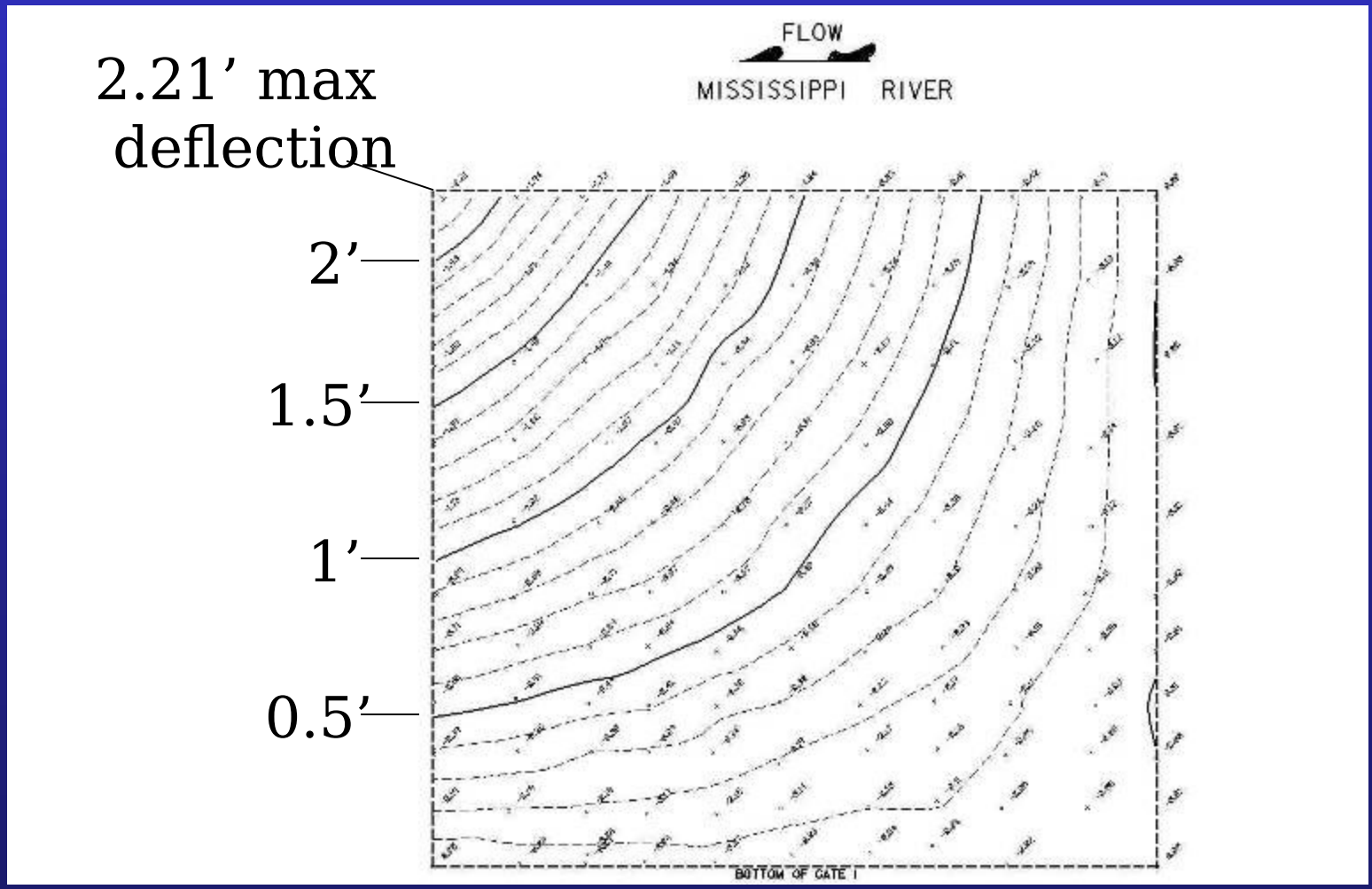
Survey Results – Illinois Leaf



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What Do We Do Now?

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Panel of Experts

- Retired construction and operations personnel from USACE (Similar Failure At Bankhead)
- Steel structures engineering experts from various universities
- Heat straightening expert
- Structural engineers from other USACE offices
- St. Louis District structural engineers, lock operations personnel and Rivers Project Office personnel

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Conclusions From Panel of Experts

- Gate could be repaired
- Repair would be quicker than replacement
- Heat straightening could be used
- Leafs should be layed down for repairs

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Gate Repairs

Laying Leafs Down

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Original Lifting Beam For Vertical Lifting Only

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Redesigned Lifting Beam

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Lifting Beam In “Green Monster” Test Rack

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Installing Lifting Beam

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Turning Feet for Gate Laydown

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Removing Guy Cables

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Shreve Moving Leaf For Lay Down

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Aligning Turning Feet on Support Stand

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In Position for Laydown

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Rotation on Turning Feet

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Shreve Setting Leaf Horizontal

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Gate on Support Stands

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Gate Leafs in Horizontal Position

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Leaf Supported In Deflected Position

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Enclosure on Delong Barge at Service Base

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Gate Repairs

Heat Straightening

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Heat Straightening Crew

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Heat Straightening

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Spot Heats

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Heat Straightening Diagonals

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Diaphragms Before Heat Straightening

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Diaphragm After Heat Straightening

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Support Condition For Checking Straightness

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Gate Repairs

Structural Repairs

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Revised Strut Arms and New Pintle Sockets

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Machining Strut Arm at Service Base

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Fabrication Work at Service Base

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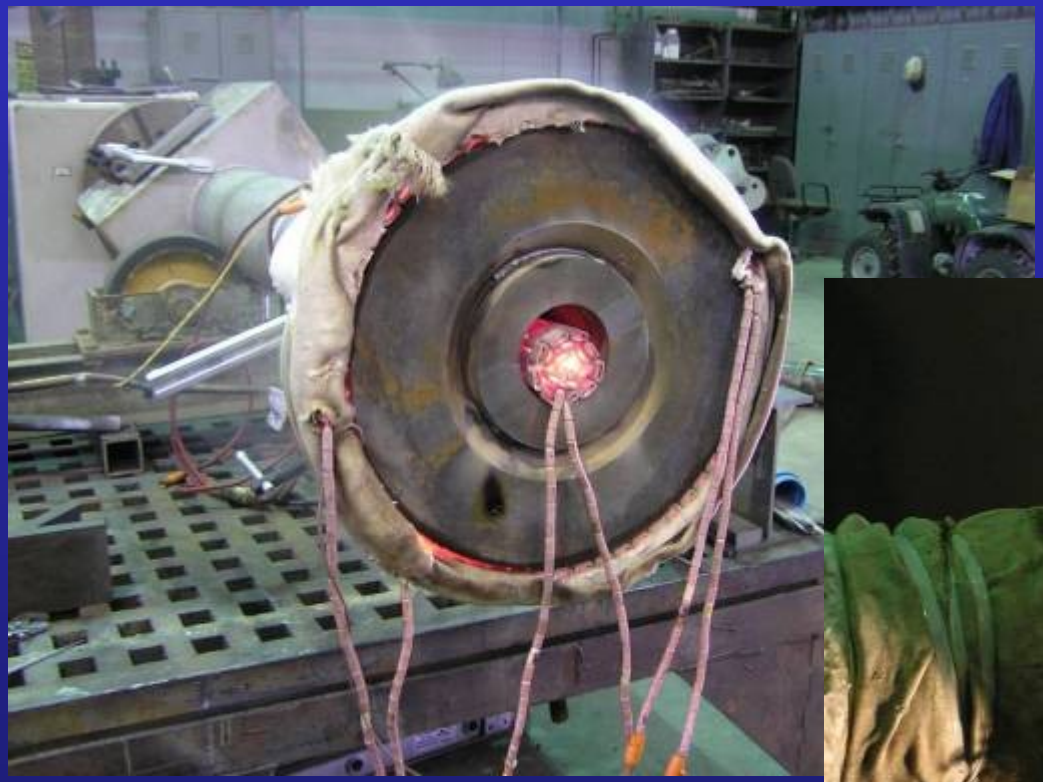
Welding Strut Arm at Service Base



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Modified Bottom End of Diagonal

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Modified Bottom Diagonal Gussets

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Modified Bottom End of Diagonal

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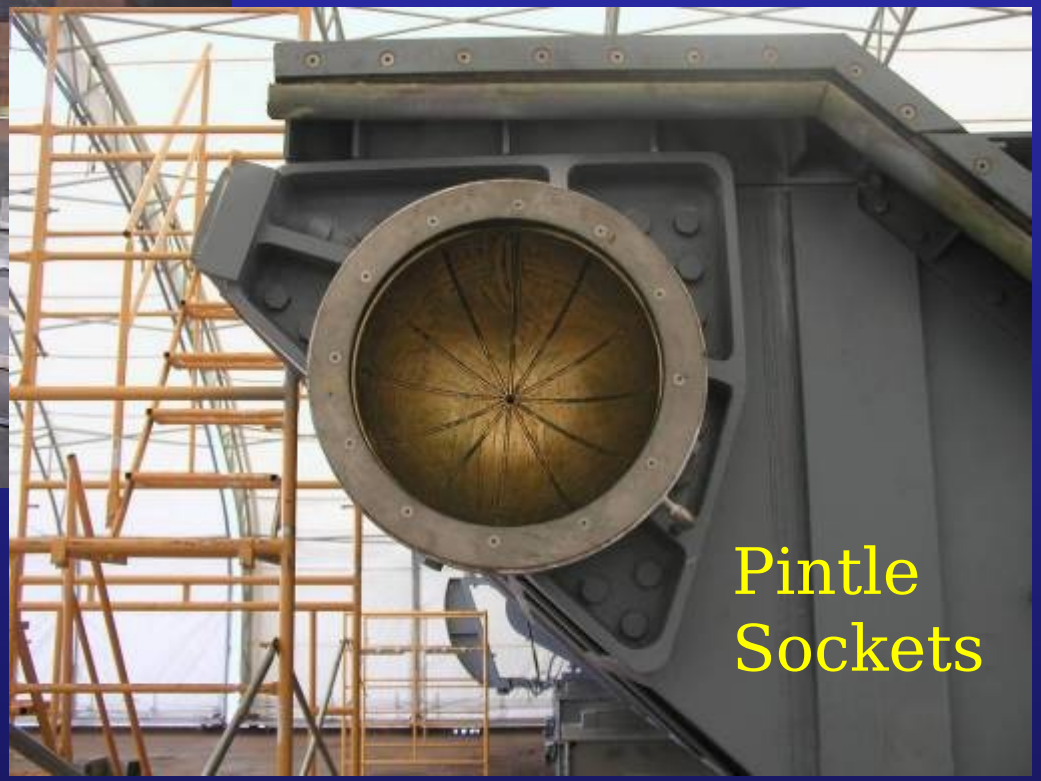
Castings Supplied By Rock Island Arsenal

Anchor Bars And Gudgeon Barrels



Pintle Sockets

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Gate Stops on Miter Gate Sill

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Lifting Repaired Leafs Vertical

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Installing Lifting Device

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Shreve Lifting Leaf Vertical

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Shreve Lifting Leaf Vertical

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Placing Leaf In Toaster

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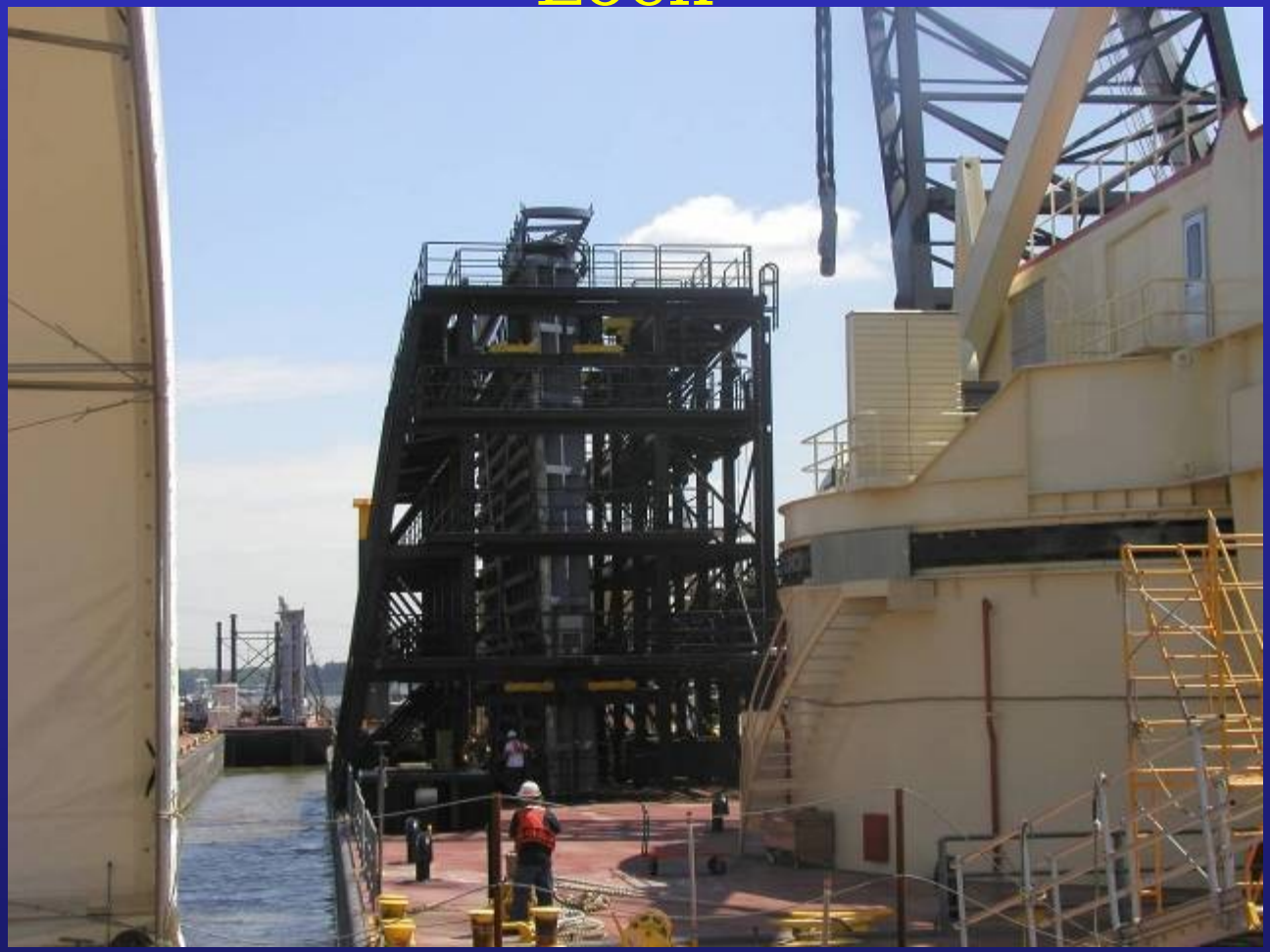
Leafs In Toaster for Transport to Lock



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Reinstalling Gate

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Repaired Illinois Leaf in Place

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Welding & Boring Gudgeon Pin Plates

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Welding & Boring Gudgeon Pin Plates

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Installing Missouri Leaf

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Repaired Gate Leafs in Place

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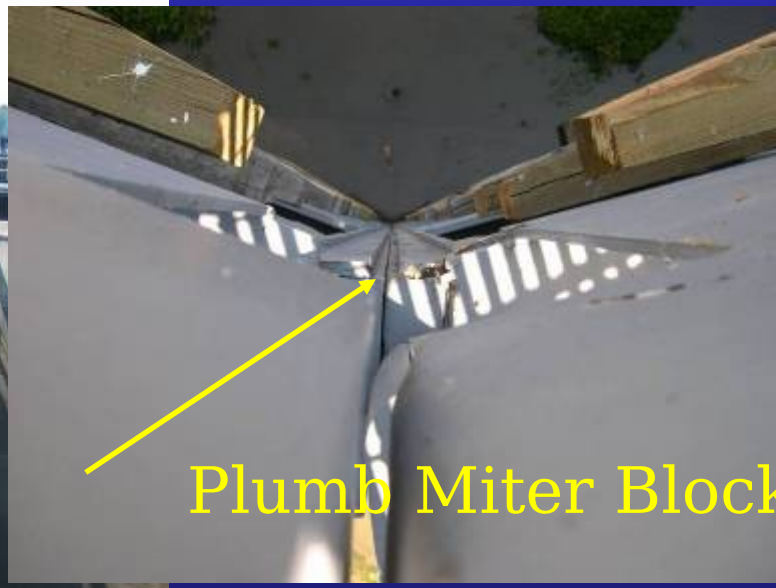
Repaired Gate Leafs in Place



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July 2005 - Auxiliary Lock Back In Service

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Thank You !!!

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